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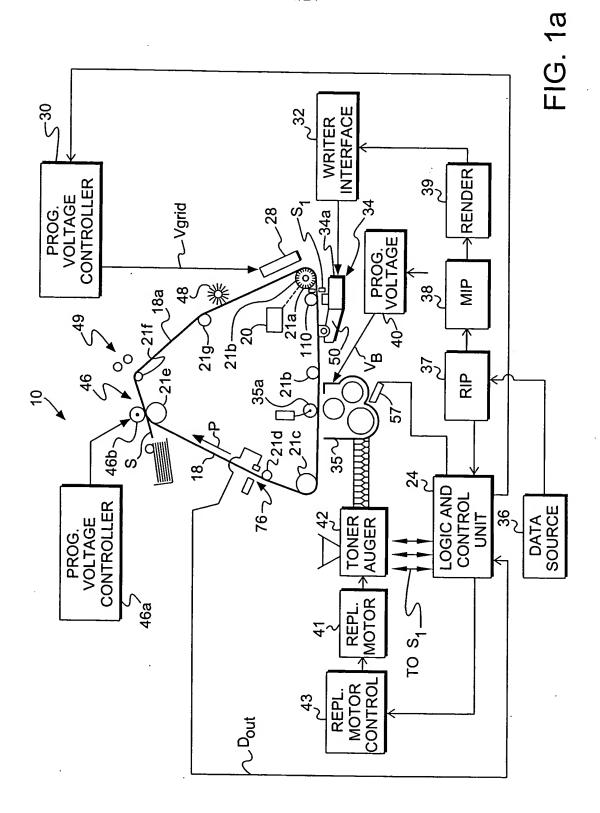
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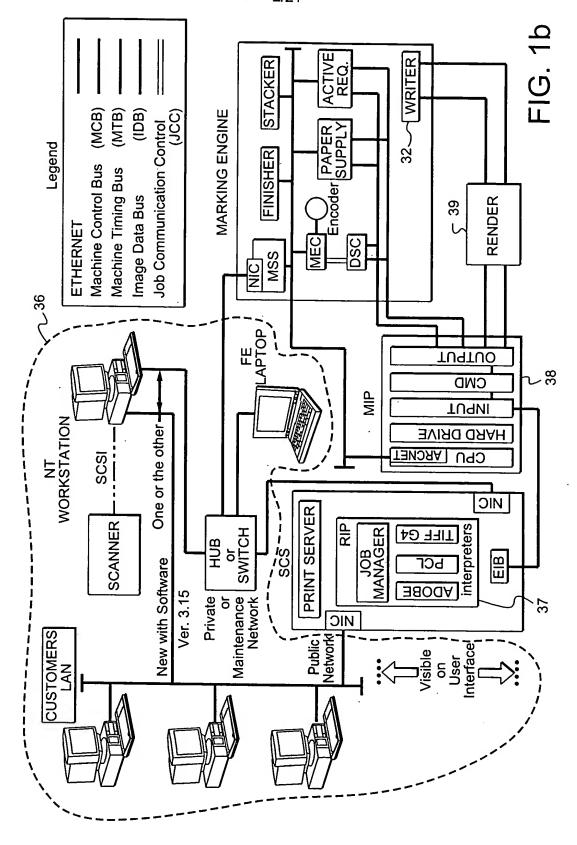
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- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

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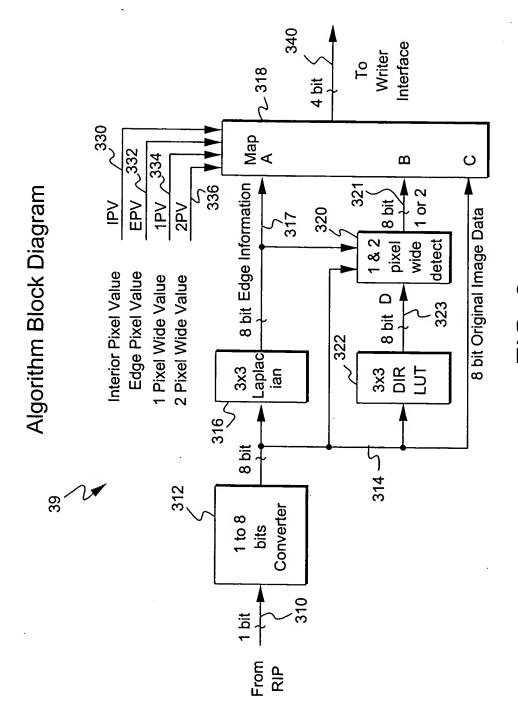


FIG. 2

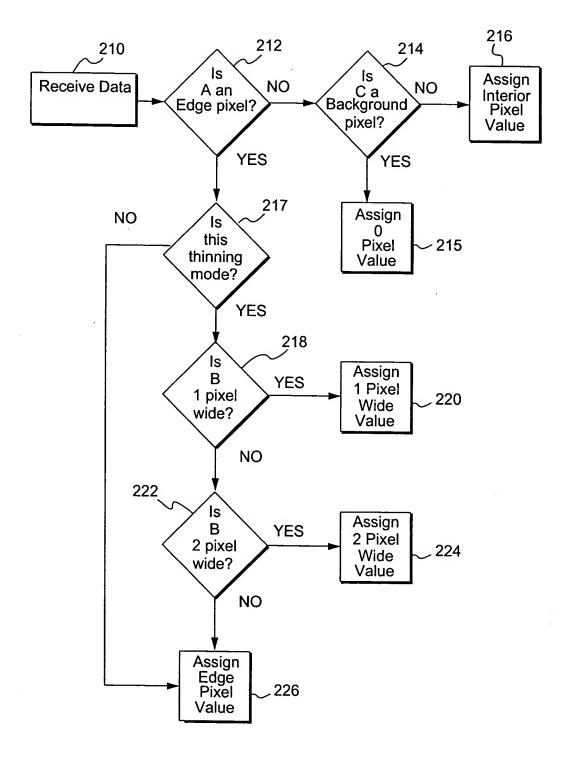
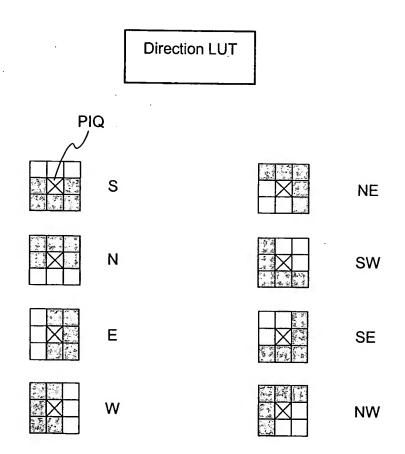
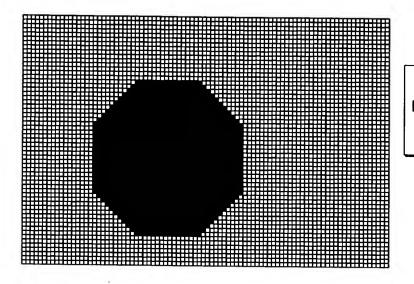


FIG. 3



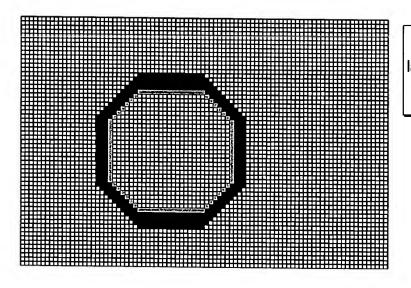
All other combinations result in zero.

FIG. 4



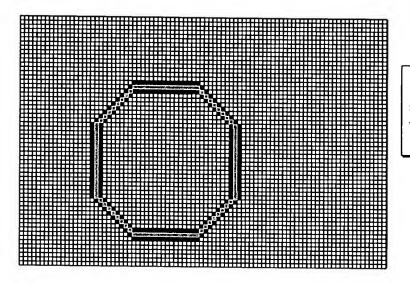
Original object bitmap

FIG. 5a



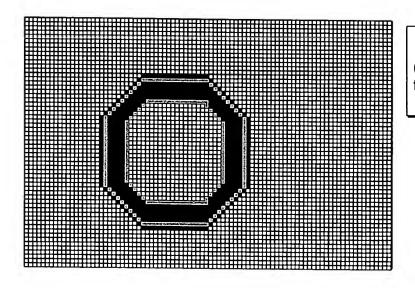
Four onion skin layers when thinning

FIG. 5b



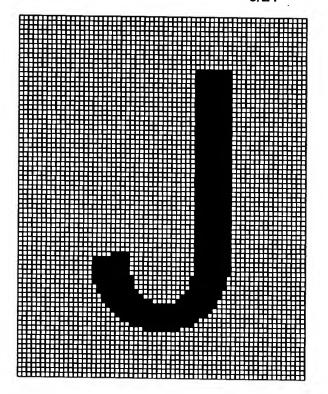
Three onion skin layers when thickening

FIG. 5c



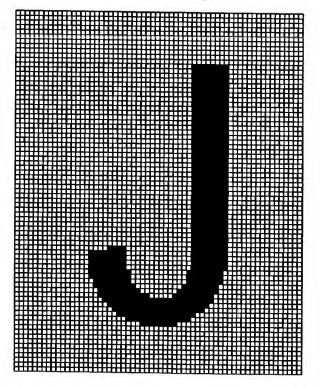
All layers (thickening and thinning)

FIG. 5d



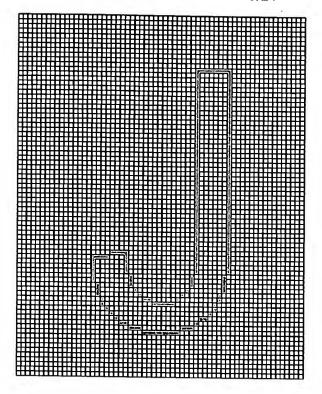
Original Binary Bitmap

FIG. 6a



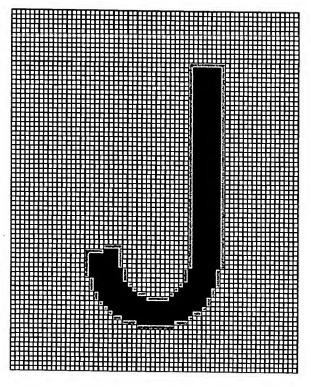
Same grey level pixel value value assigned to edges and solid area density

FIG. 6b



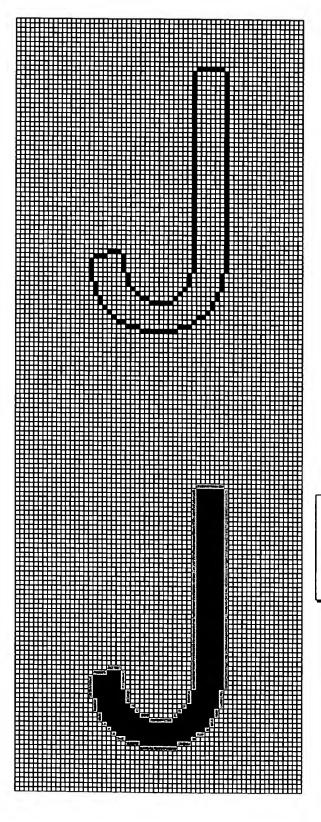
Edges when thinning

FIG. 6c



Lightened-Solid area density reduced Letter thinner

FIG. 6d



Edges when thickening

FIG. 6e

Thickened Letter thickened by applying gray to edges which were originally white

FIG. 6f

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### 1 Pixel Wide Detection

Original 1 pixel wide line

FIG. 7a

Edge Pixels

FIG. 7b

**Direction Values** 

FIG. 7c

Assignment BP: Background Pixel

FIG. 7d

EP: Edge Pixel

1W: One Pixel Wide Line

BP BP BP BP BP BP BP BP BP 1W BP BP BP BP BP BP EP BP BP

0 0 0

0 255

0 255

0 255

0 255

0 255

0 255

0 255

0 SE S SW 0 E

S W

0 W

0 W

0 W

0 W

0 W 0 W

NW

NNW 0

BP BP BP BP BP BP BP BP BP BP

0

이

0

0

0 0 255

0

0

0

0 0 0

0 0

0

0

0

0 0

0

0

0

0

0

0 0 0 0 0

0 0

0 0 0 0

0 E

0 E

0 E

0 E

0 E

0 NE

0

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## 2 Pixel Wide Detection

Original 2 pixel wide line

FIG. 8a

Edge Pixels

FIG. 8b

**Direction Values** 

FIG. 8c

FIG. 8d

Assignment

**BP: Background Pixel** 

EP: Edge Pixel

2W: Two Pixel Wide Line

BP BP EP BP BP BP BP BP 2W 2W BP BP BP BP BP 2W 2W BP BP BP BP BP 2W 2W BP BP BP

0 0 0

0 255 255

0 255 255 0 255 255

0 255 255

0 255 255

0 255 255

0 255 255

0 255 255

0 E SESW W

E E W W

E NENW W

BP BP BP BP BP BP BP BP BP BP

E E

E E

O NE N

0

0 SE S

0

0

이

SSW

W W

W W

w w W W

w w

NNN

0

0

0

0 0

0

0

0

BP BP 2W 2W BP BP BP BP BP 2W 2W BP BP BP BP BP 2W 2W BP BP BP BP BP EP EP BP BP

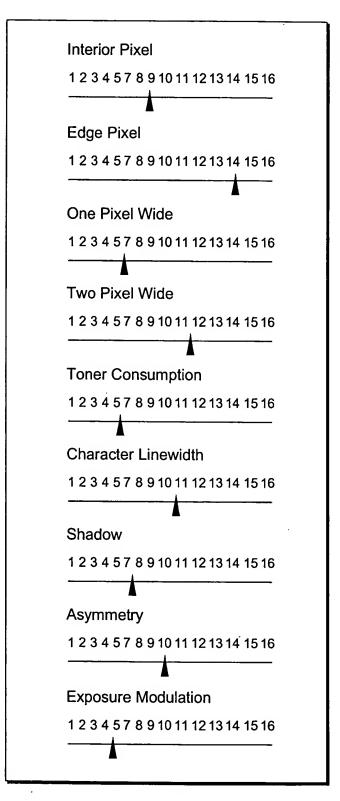


FIG. 9

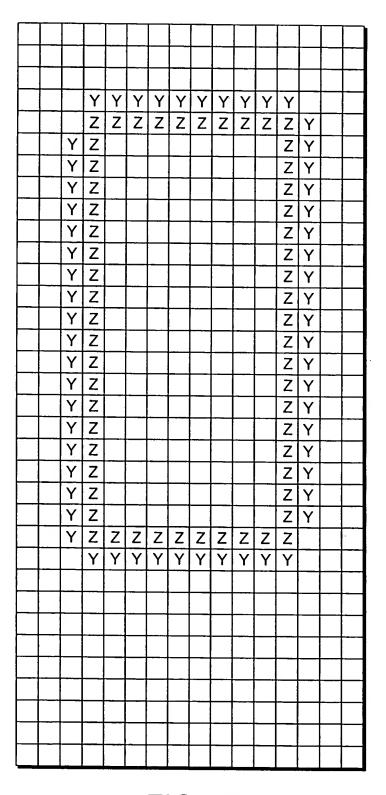


FIG. 10

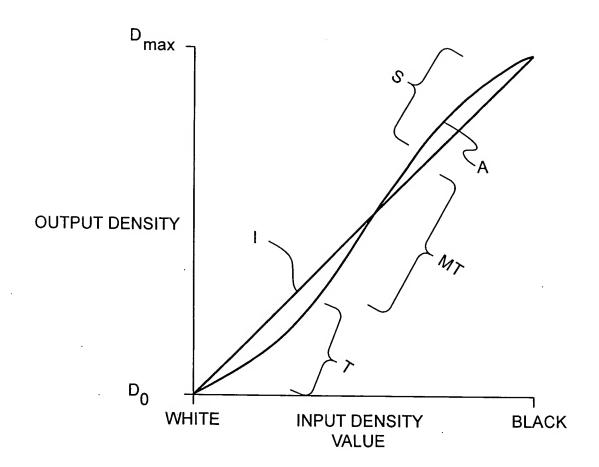


FIG. 11

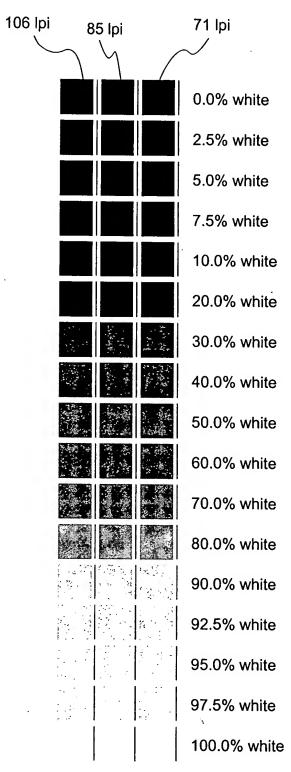


FIG. 12

default round round 106 85 71

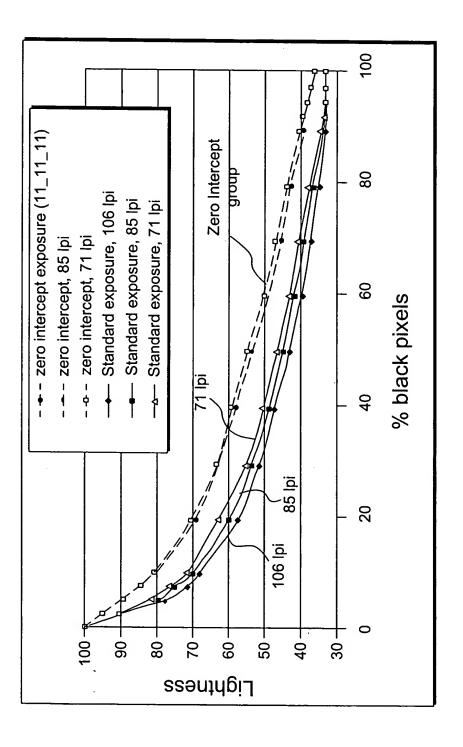


FIG. 13

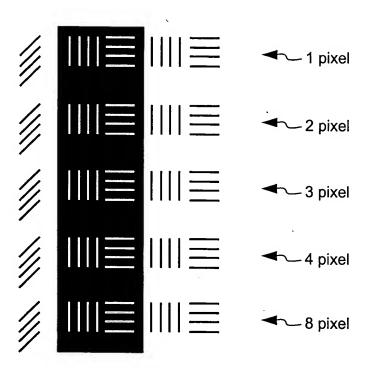
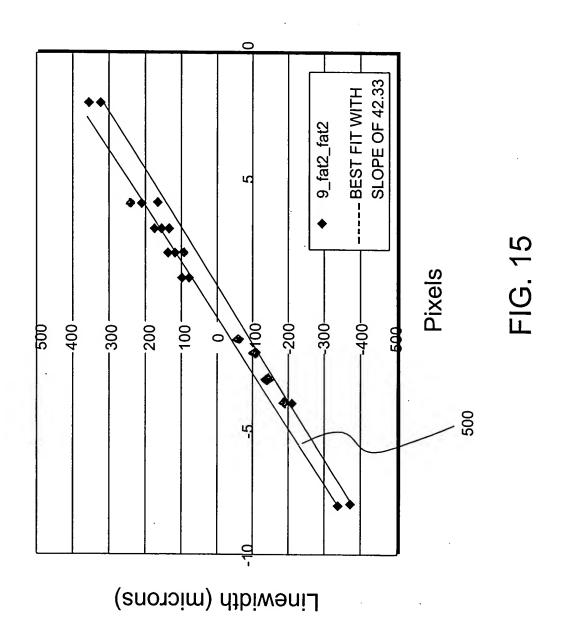


FIG. 14



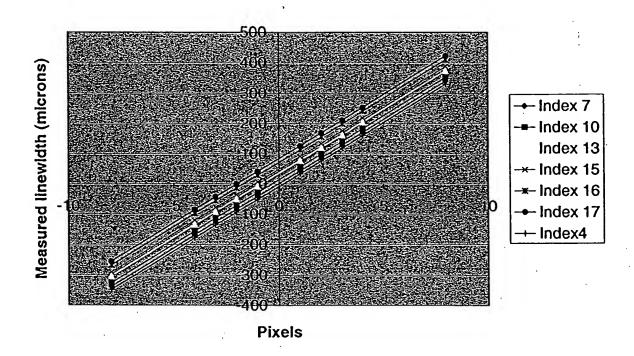


Fig. 16

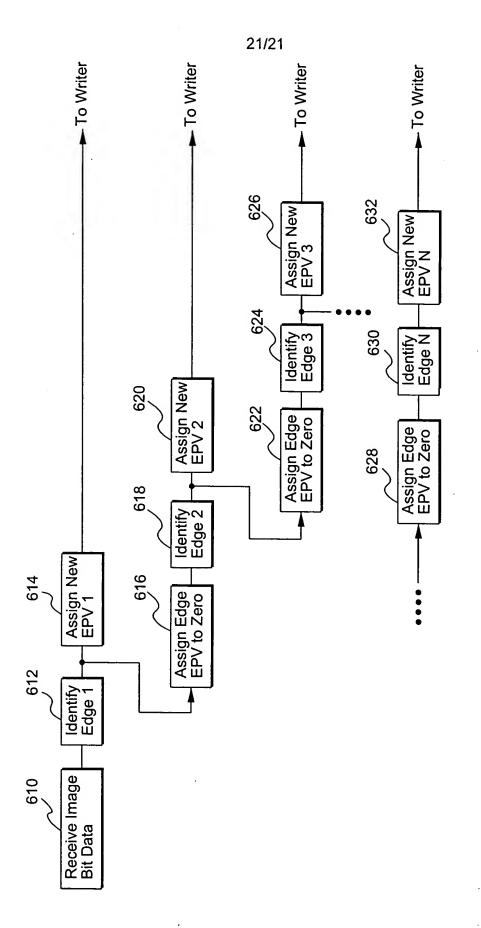


FIG. 17